

Items #51-52: Soil Quality

Evaluation Objectives: To evaluate the effects of project activities on soil productivity.

Methods: We monitor a sample of selected vegetation management projects to determine the extent of detrimental soil conditions. Most units sampled were identified prior to implementation during the NEPA process.

Soil quality monitoring is a systematic process by which data are collected to determine whether or not soil management objectives have been achieved. Monitoring provides information to assist land managers in making better decisions to maintain or improve long-term soil productivity

Another goal of soil monitoring was to determine if design features for various timber management activities are effective at maintaining soil quality

Soil productivity is defined as the inherent capacity of a soil to support the growth of species plants, plant communities, or a sequence of plant communities (FSH 2509.18 – Soil Management Handbook). In order to monitor the status of soil productivity, we look at the incidence of soil conditions that reduce productivity. These conditions are called detrimental soil disturbance. These disturbances include the effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement. All new activities are designed to create less than 15 percent detrimental soil conditions within an activity area such as a timber harvest cutting unit (FSM 2500 – Watershed and Air Management R-1 Supplement 2500-99-1) Detrimental conditions include:

- **Compaction** - Detrimental compaction is a 15 percent increase in natural bulk density. The cumulative effects of multiple site entries on compaction should also be considered since compacted soils often recover slowly
- **Rutting** - Wheel ruts at least 2 inches deep in wet soils are detrimental
- **Displacement** - Detrimental displacement is the removal of 1 or more inches (depth) of any surface soil horizon, usually the A horizon, from a continuous area greater than 100 square feet
- **Severely-Burned Soil** - Physical and biological changes to soil resulting from high-intensity burns of long duration are detrimental. This standard is used when evaluating prescribed fire guidelines for assessing burn intensity are contained in the Burned-Area Emergency Rehabilitation Handbook (FSH 2509.13)
- **Surface Erosion** - Rills, gullies, pedestals, and soil deposition are all indicators of detrimental surface erosion. Minimum amounts of ground cover necessary to keep soil loss to within tolerable limits (generally less than 1 to 2 tons per acres per year) should be established locally depending on site characteristics
- **Soil Mass Movement** - Any soil mass movement caused by management activities is detrimental

A total of 70 units were monitored between the 1999 and 2007 monitoring report summary period. Treatments monitored range from tractor yarding to helicopter yarding. Activities occurred in both summer and winter. Several units were monitored before and after salvage logging efforts.

During the monitoring summary period, detrimental soil disturbance monitoring shifted from a modified Howes method to the Northern Region Soil Disturbance Monitoring Protocol. This protocol provides a consistent and repeatable method to measure visual physical soil indicators and establishes a standard inventory, monitoring and assessment tool

Monitoring occurred within the following projects/sales:

- Ball Fire Salvage
- Beta Fire Salvage
- Blackfoot North Fire Salvage
- Blackfoot South Fire Salvage
- Crazy Horse Fire Salvage
- Depuy
- Help Creek
- Hornet Fire Salvage
- Hunger Henry
- McGinnis
- Moose Fire Salvage
- Spotted Beetle
- Swaney Salvage
- Tepee Salvage (GVRD)

Evaluation: The design features and mitigation measures used during planning and implementation of timber management activities effectively protected soils and met the soil quality guidelines on 68 of 70 monitored units.

Based on monitoring, winter logging continues to be a successful option for reducing the risk of detrimental soil disturbance where past activities have occurred or where fire salvage operations are planned. It is often difficult to detect soil disturbance within units that were winter salvage logged.

Implementation of the Northern Region Soil Disturbance Monitoring Protocol has been successful. This new protocol has increased the quality of data collected while somewhat decreasing data collection rates due to increased data collection requirements

Monitoring of Second Entries: Several units that were logged as part of the Moose Fire Salvage project had existing detrimental soil disturbance from previous timber management activities. A seasonal crew performed modified Howes transects in these units to quantify detrimental soil disturbance prior to salvage logging. A different crew re-surveyed these units after project implementation. These monitoring results were examined using statistical analysis (Table 51-1).

Table 51-1. Moose Fire Salvage Monitoring Results

Unit Number	Salvage Logging Method/Season	Pre-Salvage Detrimental Soil Disturbance Percent	Post-Salvage Detrimental Soil Disturbance Percent (95% Confidence Interval)
3	Ground/Winter	8	2 (-5 to 9)
8	Ground/Winter	21	27 (14 to 28)
8a	Ground/Winter	0	4 (-3 to 12)
9	Helicopter	3	2 (-6 to 9)
10	Ground/Summer	2	2 (-5 to 10)
12	Helicopter	11	0 (-8 to 8)
19b	Ground/Winter	18	0 (-7 to 7)
20	Ground/Winter	13	4 (-3 to 11)
23	Helicopter	3	0 (-8 to 8)
26	Helicopter	22	7 (-1 to 15)
27	Ground/Summer	5	3 (-4 to 9)
28	Ground/Winter	2	0 (-8 to 8)
29	Ground/Summer	3	1 (-7 to 9)
35	Ground/Winter	10	1 (-7 to 9)
38	Ground/Winter	1	0 (-8 to 8)
41b	Helicopter	2	0 (-8 to 8)
43	Ground/Summer	4	0 (-8 to 8)

Two units in the Moose Fire Salvage project exceeded the regional soil quality guideline. These units both exceeded the soil quality standard prior to Moose Fire Salvage implementation. Monitoring after salvage logging was inconclusive as to whether the logging increased the amount of detrimental soil disturbance in these units.

Recommended Action: Continue to monitor the effects of vegetation management activities using the Northern Region Soil Disturbance Monitoring Protocol. This information provides excellent direction for project design and the protection of long-term productivity. Continued collection of this data will also provide us with more precise estimations of potential effects of planned management activities to improve future soil resource effects analyses.